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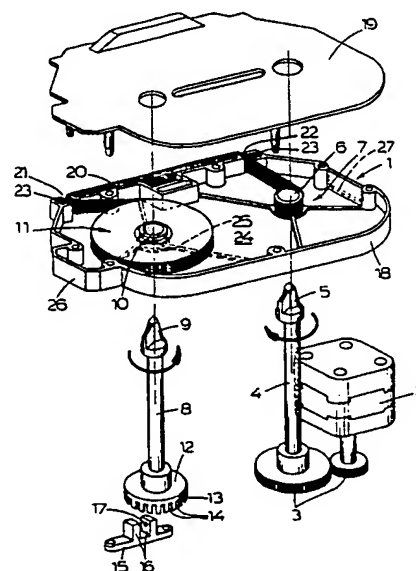
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## (54) Apparatus for driving a ribbon cassette.

(57) An apparatus for driving a ribbon cassette (1) for a printer, which ribbon cassette includes a supply spool (11) and a take-up spool (7) between which an inked ribbon (20) extends, comprises a motor (2) for driving a driving shaft (4). The driving shaft can be directly coupled to the take-up spool of the ribbon cassette. A detector provides a signal to a processing unit in response to the ribbon transport, which processing unit can operate the motor for transporting a length of the ribbon as determined by a printed character.

A ribbon cassette to be used at a printer with such an apparatus, comprises a cassette casing (18) with an output (21) and a feed opening (22), a supply (11) spool with a ribbon supply and a take-up (7) spool for the used ribbon. The inked ribbon is directly led from the supply spool through the output and feed openings to the take-up spool. Both spools each are provided with a hollow spool hub (6, 10) which is accessible to and can be coupled with a driving shaft (4) and a detection shaft (8), respectively, through an opening formed in the bottom wall (24) of the cassette casing.



EP 0 121 971 A1

## Apparatus for driving a ribbon cassette.

The invention relates to an apparatus for driving a ribbon cassette for a printer, wherein the ribbon cassette includes a supply pool and a take-up spool, between which an inked ribbon extends, said apparatus comprises a motor for driving a driving shaft to which the ribbon cassette can be coupled, and a processing unit for operating the motor to transport a length of the ribbon determined by a printed character, and to a ribbon cassette to be used in a printer, said ribbon cassette comprises a cassette casing with an output and a feed opening, a supply spool with a ribbon supply and a take-up spool for the used ribbon.

At the known apparatus of this type the driving shaft is coupled with a transport roll mounted in the ribbon cassette by means of which the ribbon is drawn off the supply spool. Said transport roll is coupled to the take-up spool by a belt coupling, whereby the transported ribbon is wound upon the take-up spool. The transport roll co-operates with a pressure roll also mounted in the ribbon cassette, which pressure roll presses the ribbon against the transport roll to guarantee the transport of the ribbon during rotation of the transport roll. Although the construction of this known apparatus is relatively simple, this apparatus shows the disadvantage that a rather complicated ribbon cassette has to be used, whereby several problems may arise in practice. If for example insufficient friction is present between the pressure roll and the transport roll, the transport roll can slip with respect to the ribbon, which causes an inaccurate ribbon transport. If the pressure roll is pressed too strongly against the transport roll, wrinkles and ridges develop in the transported ribbon, which gives problems at winding the ribbon on the take-up spool. A further significant problem at this ribbon cassette is formed by the belt coupling between the transport roll and the take-up spool. When this belt coupling slips insufficiently, the ribbon will break immediately, while at too much slipping, the take-up spool will be slow. In both cases the cassette will eventually seize.

The invention aims to provide an apparatus of the above-mentioned kind, in which said disadvantages are obviated in a simple but nevertheless effective manner.

To this end, the apparatus according to the invention is characterized in that the driving shaft can be directly coupled with the take-up spool of the ribbon cassette, and in that a detector is provided, which detector provides a signal to the processing unit in response to the ribbon transport.

In this manner an accurate ribbon transport is guaranteed under all circumstances, wherein the processing unit can easily derive the transported length of the ribbon from the signal received from the detector.

As a continuous measurement of the transported length of the ribbon is not necessary for an accurate ribbon transport, the apparatus according to the invention is preferably characterized in that the processing unit determines the ribbon supply in the ribbon cassette by means of a memory in which angular rotation values belonging to a predetermined signal of the detector and corresponding to consecutive values of the ribbon supply, are stored, wherein after reception of a control impulse the processing unit operates the motor until said predetermined signal of the detector is received, wherein the processing unit measures the actual angular rotation value and compares the measured value with the stored angular rotation values in order to determine the ribbon supply present, whereafter the processing unit energizes the motor at each printed character for an angular rotation determined by the ribbon supply present and the printer character.

Thereby, an accurate ribbon transport is guaranteed for the complete ribbon supply of the ribbon cassette in a simple manner.

According to the invention a switching means is provided for delivering a control impulse to the processing unit at opening and closing a protection cover of the printer through which cover the ribbon cassette is accessible.

Further means may be provided for delivering a control impulse to the processing unit each time after

printing a number of characters.

In this manner it is obtained that the ribbon supply present is regularly determined, which takes place in any case if the ribbon cassette may possibly be replaced.

5 Further, the invention provides a ribbon cassette to be used in a printer, said ribbon cassette comprises a cassette casing with an output and a feed opening, a supply spool with a ribbon supply and a take-up spool for the used ribbon, said ribbon cassette according to the invention being  
10 characterized in that the inked ribbon is directly led from the supply spool through the output and feed openings to the take-up spool, wherein both spools each are provided with a hollow spool hub which is accessible for and can be coupled with a driving shaft and a detection shaft, respectively,  
15 through an opening formed in the bottom wall of the cassette casing.

In this manner a very simple ribbon cassette is obtained, which consists of a minimum number of parts and can be manufactured at low costs. The operational reliability of  
20 the ribbon cassette according to the invention is very high.

The invention will hereinafter be further explained by reference to the drawings, in which embodiments of the apparatus and ribbon cassette according to the invention are shown.

25 Fig. 1 shows a perspective view of a part of the apparatus according to the invention for driving a ribbon cassette according to the invention.

Fig. 2 shows a block diagram of the electronical part of the apparatus according to the invention.

30 Fig. 1 shows the mechanical part of an apparatus for driving a ribbon cassette 1, and fig. 2 shows the corresponding electronical part in the form of a block diagram. Such an apparatus is used in a printer of the daisy wheel type, which for example is used in a word processor to obtain  
35 a fine, good readable print of the formed text.

The apparatus comprises a motor 2 driving a driving shaft 4 through gears 3. The driving shaft 4 has a driving head 5 at the end opposite of the gear 3, which driving head 5 can be coupled with a spool hub 6 of a take-up

0121971

spool 7 of the ribbon cassette 1. Further, the apparatus comprises a detection shaft 8, one end of which carries a driven head 9 which can be coupled with a spool hub 10 of a supply spool 11 of the ribbon cassette 1. The detection shaft 8 carries at the end opposite of the head 9 a disc 12 with a downwardly projecting circumferential edge 13. A number of slits 14 regularly distributed along the circumference of the disc 12 are provided in the edge 13. Further, a mounting block 15 is provided, two portions 16 of which extend upwardly, the edge 13 of the disc 12 lying between said parts 16. A light source not shown is mounted in the one part 16, while a phototransistor 17 is provided in the other part 16. During rotation of the disc 12 the phototransistor 17 will therefore deliver an impulse-shaped signal.

As shown in fig. 1 the ribbon cassette is provided with a cassette casing 18 in which the take-up spool and the supply spool 11 are accommodated. The cassette casing 18 is closed by a cover 19. The inked ribbon 20 extends from the ribbon supply on the supply spool 11 through an output opening 21 and a feed opening 22 directly to the take-up spool 7. Brake pads 23 are provided in the output opening 21 and the feed opening 22, respectively, which brake pads 23 prevent a rolling through of the supply and take-up spools 11, 7 at stopping the driving by the driving shaft 4 and maintain the portion of the ribbon 20 lying outside of the ribbon cassette 1 in a tight condition. Therefore, the ribbon cassette 1 is constructed in a very simple manner with a minimum of parts and has a very high operational reliability.

In the bottom wall 24 of the cassette casing 18 openings 25 are provided, through which the hollow spool hubs 6, 10 of the take-up and supply spools, respectively, are accessible for the heads 5, 9 of the driving shaft 4 and the detection shaft 8, respectively. In fig. 1 only opening 25 for the spool hub 10 is visible. In a manner not further shown the spool hubs 6, 11 are provided with a suitable toothing at the inner side so that a reliable coupling with the heads 5, 9 is guaranteed.

Further, the ribbon cassette has a projecting boss 26 and a locking edge 27 formed at the opposite side, by

means of which the ribbon cassette 1 can be locked in the printer.

Fig. 2 shows a block diagram of the electronical part of the apparatus described, which comprises a processing unit 28 including a microprocessor. The processing unit 28 operates the motor 2 made as a stepping motor, through a control means 29. The phototransistor 17 operates as a detector providing an impulse-shaped signal in response to the ribbon transport to a comparator the output of which delivers a digital impulse signal to the processing unit 28. In this manner the processing unit 28 receives at operating the stepping motor 2 information on the corresponding ribbon transport.

For printing the different characters the processing unit 28 operates the stepping motor 2 in a usual way in such a manner that after each printed character a length of the ribbon 20 as determined by the printed character is transported. To this end, the processing unit 28 receives data about the printed character through an input 31. The length of the ribbon 20 transported at each step of the stepping motor 2 will however vary during the use of the ribbon cassette 1 so that the processing unit 28 has to determine the actual transported length of the ribbon 20.

To this end the processing unit 28 can determine the ribbon supply present on the supply spool 11 of the ribbon cassette 1 by means of the phototransistor 17 and a memory 32. The complete ribbon supply of the ribbon cassette 1 is divided in a number of consecutive sections, wherein it is assumed for each section that at a given number of steps of the stepping motor 2 substantially the same length of the ribbon 20 will be transported. For the consecutive sections of the ribbon supply step numbers for the stepping motor 2 or angular rotation values of the take-up spool 7 belonging to a predetermined plurality of impulses of the phototransistor 17, are stored in the memory 32. By operating the stepping motor 2 until the predetermined plurality of impulses from the phototransistor 17 is received the processing unit 28 can compare the required number of steps of the stepping motor 2 with the stepping numbers stored in the memory 32, from which follows which section of the ribbon supply is used at

0121971

present.

The ribbon supply present in the ribbon cassette should be determined in any case when an other ribbon cassette is placed in the printer. To this end, a switching means 5 33 is provided which delivers a control impulse to the processing unit 28 at opening and closing a not shown protection cover of the printer through which the ribbon cassette is accessible. Further, the ribbon supply may regularly be determined during operation of the printer, for which purpose a 10 means 34 is provided for delivering a control impulse to the processing unit 28 each time after printing a number of characters. After receiving a control impulse the processing unit 28 first operates the stepping motor 2 until a first impulse is received from the phototransistor 17. Thereby it 15 is guaranteed that the ribbon 20 is tightened and that the determination of the ribbon supply is initiated at one and the same position of the disc 12 with respect to the phototransistor 17. Subsequently, the processing unit counts the number of steps of the stepping motor 2 required until the 20 predetermined number of impulses, for example two, is received from the phototransistor 17. The processing unit 28 compares said number of steps with the step numbers stored in the memory 22, from which follows which section of the ribbon supply is used at the moment. Thereafter, the processing unit 25 28 can operate the stepping motor 2 at each printed character for transporting the desired length of the ribbon 20.

As an alternative it is possible to use a detector providing a signal to the processing unit 28 proportional to the ribbon transport so that the actual transported length of 30 the ribbon is continuously measured. However, such an accurate continuous measurement is not necessary in practice.

The described manner for determining the actual transported length of the ribbon shows the advantage that the phototransistor 17 directly co-operates with the supply 35 spool 11 of the ribbon cassette 1 so that the output signal of the phototransistor 17 provides a reliable indication of the transport of the ribbon 20. Moreover, the phototransistor 17 may now also be used to detect a ribbon breakage or the depletion of the ribbon supply of the ribbon cassette 1.

To this end, the processing unit 28 delivers an alarm signal to an indicator 35 if after reception of the control impulse of the switching means 33 or the means 34 an impulse is not yet received from the phototransistor 17 after a predetermined number of steps of the stepping motor 2. Thereby it is indicated to the user of the printer that the ribbon cassette 1 should be replaced.

The invention is not restricted to the above-described embodiment which can be varied in a number of ways within the scope of the invention.





0121971

Claims

1. Apparatus for driving a ribbon cassette for a printer, wherein the ribbon cassette includes a supply spool and a take-up spool, between which an inked ribbon extends, said apparatus comprises a motor for driving a driving shaft  
5 to which the ribbon cassette can be coupled, and a processing unit for operating the motor to transport a length of the ribbon determined by a printed character, characterized in that the driving shaft can be directly coupled with the take-up spool of the ribbon cassette, and in that a detector  
10 is provided, which detector provides a signal to the processing unit in response to the ribbon transport.

2. Apparatus according to claim 1, characterized in that the processing unit determines the ribbon supply in the ribbon cassette by means of a memory in which angular  
15 rotation values belonging to a predetermined signal of the detector and corresponding to consecutive values of the ribbon supply, are stored, wherein after reception of a control impulse the processing unit operates the motor until said predetermined signal of the detector is received, wherein  
20 the processing unit measures the actual angular rotation value and compares the measured value with the stored angular rotation values in order to determine the ribbon supply present, whereafter the processing unit energizes the motor at each printed character for an angular rotation determined  
25 by the ribbon supply present and the printer character.

3. Apparatus according to claim 2, characterized by a switching means for delivering a control impulse to the processing unit at opening and closing a protection cover of the printer through which cover the ribbon cassette is ac-  
30 cessible.

4. Apparatus according to claim 2 or 3, characterized by means for delivering a control impulse to the processing unit each time after printing a number of characters.

35 5. Apparatus according to claim 2, 3 or 4, characterized in that the detector generates an impulse signal at the transport of the ribbon, wherein said predetermined

signal of the detector corresponds to at least one impulse.

6. Apparatus according to claim 5, characterized in that after reception of a control impulse the processing unit only initiates the measurement of the angular rotation  
5 after reception of a first impulse from the detector.

7. Apparatus according to claim 6, characterized in that the processing unit delivers an alarm signal to an indicator if no impulse is received from the detector after a predetermined angular rotation of the motor.

10 8. Apparatus according to claim 5, 6 or 7, characterized in that a rotatable detection shaft is provided, one end of which can be directly coupled to the supply spool, while the other end carries a disc having detection elements regularly distributed along its circumference, wherein the  
15 detector is located adjacent the circumference of the disc and generates an impulse at the passage of each detection element.

9. Apparatus according to claim 8, characterized in that the detector consists of a phototransistor located  
20 opposite of a light source, wherein a circumferential edge of the disc projects between the light source and the fototransistor, said circumferential edge having slits regularly distributed along the circumference.

10. Ribbon cassette to be used in a printer having  
25 an apparatus according to anyone of the preceding claims, which ribbon cassette comprises a cassette casing with an output and a feed opening, a supply spool with a ribbon supply and a take-up spool for the used ribbon, characterized in that the inked ribbon is directly led from the supply spool  
30 through the output and feed openings to the take-up spool, wherein both spools each are provided with a hollow spool hub which is accessible for and can be coupled with a driving shaft and a detection shaft, respectively, through an opening formed in the bottom wall of the cassette casing.

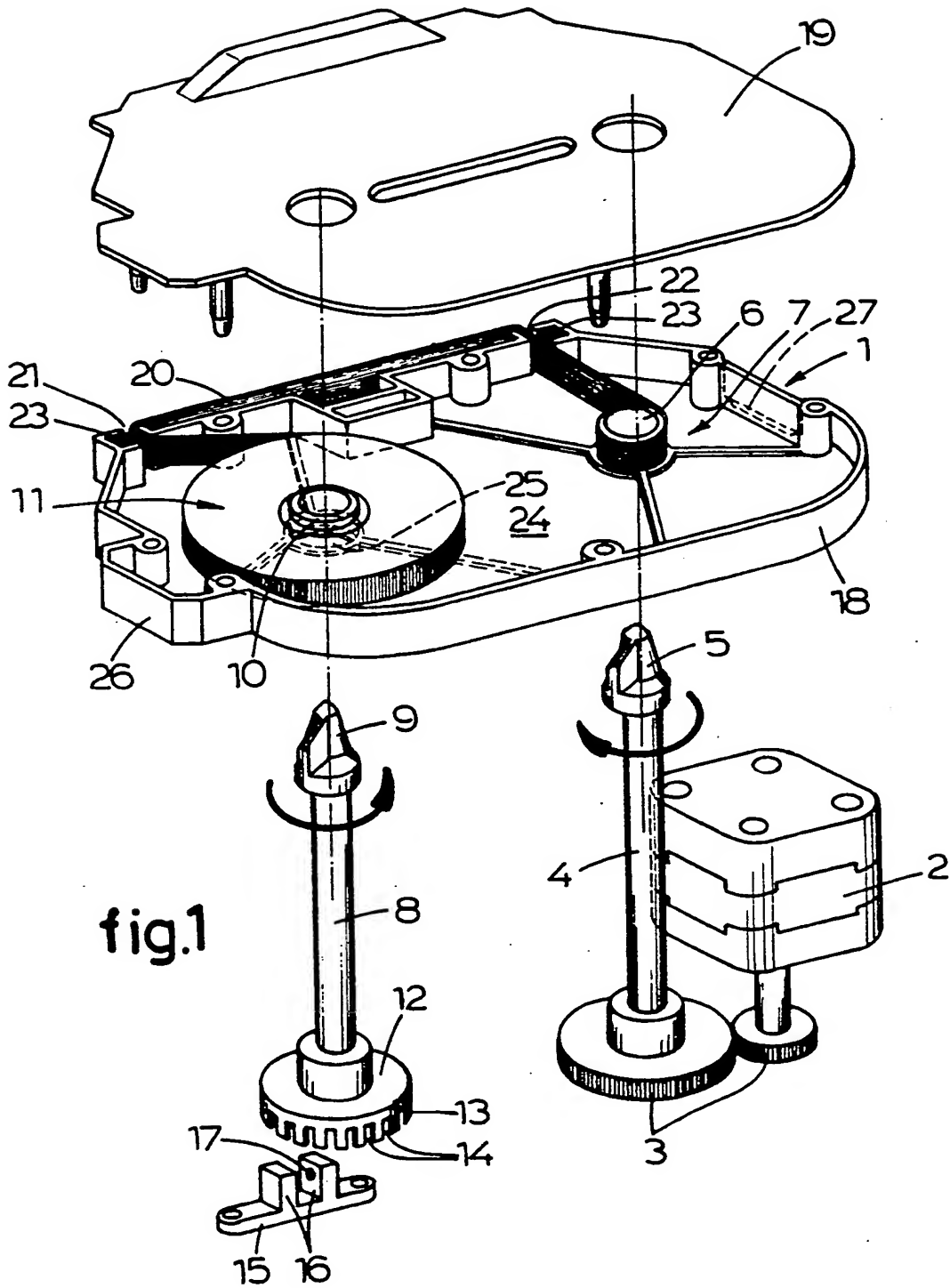
35 11. Ribbon cassette according to claim 10, characterized in that brake pads for the ribbon are provided in the output and feed openings.

12. Ribbon cassette according to claim 10 or 11, characterized in that the cassette casing comprises a pro-

0121971

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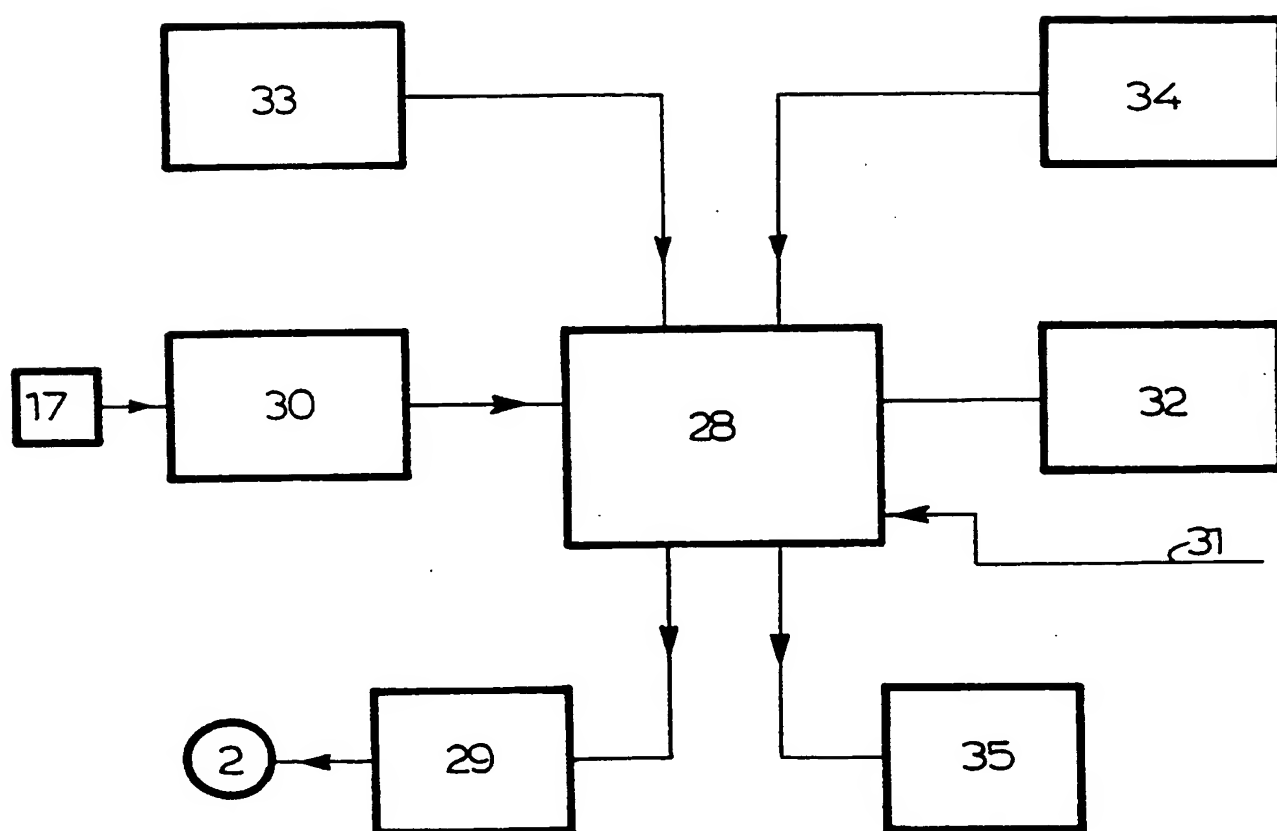


fig.2



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# EUROPEAN SEARCH REPORT

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Application number

EP 84 20 0366

| DOCUMENTS CONSIDERED TO BE RELEVANT  |   |  |  |
|--|---|--|--|
| Category   | Citation of document with indication, where appropriate, of relevant passages   | Relevant to claim                              | CLASSIFICATION OF THE APPLICATION (Int. Cl. 7) |
| A  | DE-A-2 742 974 (SIEMENS AG.)<br>* Whole document *  | 1, 6, 8  | B 41 J 33/16<br>B 41 J 35/36                   |
| A  | US-A-4 268 182 (N. MIZUTANI)<br>* Whole document *  | 1, 5, 7<br>9                                   |  |
| A  | PATENTS ABSTRACTS OF JAPAN, vol. 6, no. 129 (P-128)(1007), July 15, 1982; & JP - A - 57 52975 (CANON K.K.) 29-03-1982 | 3  |  |
| A  | FR-A-1 554 193 (IBM)  |  |  |
| A  | FR-A-2 155 539 (OLIVETTI)   |  | TECHNICAL FIELDS SEARCHED (Int. Cl. 7)         |
| A  | US-A-4 111 378 (M.L. BARWICK)   |  | B 41 J   |
| The present search report has been drawn up for all claims   |   |  |  |
| Place of search<br>THE HAGUE   |   | Date of completion of the search<br>09-07-1984 | Examiner<br>VAN DEN MEERSCHAUT G               |
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